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(54) IMPROVEMENTS IN OR RELATING TO DATA STORAGE SYSTEMS

(71) We, THE POST OFFICE, a British body corporate established by Statute, of 23 Howland Street, London, W1P 6HQ, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to data storage systems incorporating computers for processing information supplied to the storage system and has particular reference to such data storage systems access to which is available through an automatic telephone exchange system.

In such an integrated system, each telephone station can be used as a data terminal for sending data to and receiving data from the data storage system or systems. A subscriber can obtain access to another subscriber by using the device with which his station is equipped to control the switching network of the telephone exchange. The subscribers can also obtain access to data storage systems via the telephone exchange system, and then by using the same device send data and control instructions to the data storage system.

The telephone station may incorporate a telephone set of the so-called "push-button" variety. Such sets have a number of push buttons—usually ten representing the digits 0, 1, 2, 3 . . . 9 which, when actuated send a characteristic signal to line. It is necessary for a user to be able to send both data signals and command signals to the data storage system and to do this by means of the standard telephone set with which all subscribers to the telephone exchange system are supplied.

An example of such computer systems is found in U.S. Patent Specification No. 3,381,276. Push button telephone sets are used and data signals are sent by actuation of the appropriate one or other of the ten push-buttons one at a time whereas command signals are sent by the simultaneous actua-

tion of two or more of the push-buttons. The number combinations of the push-buttons taken two at a time is limited to six by reason of the circuit arrangement so that if more than six different command signals are required, the push-buttons have to be actuated simultaneously in combinations of three or more and this becomes increasingly difficult for the user.

It is an object of the present invention to provide a system not subject to the same extent, to the disadvantage just mentioned.

The present invention provides the combination, with an automatic telephone exchange system, of a data storage system including data receiving equipment and a plurality of data transmitting terminals each of which is connected to the switching network of the exchange system and includes a subscriber's telephone instrument having a plurality of signal control members actuatable to control the switching network either to obtain access to another subscriber's telephone instrument or to obtain access to the data receiving equipment and then to transmit to the data receiving equipment further signals whose significance depends upon the time interval for which the control member is actuated, the data receiving equipment comprising means responsive to the transmitted signals and to the duration thereof.

The data receiving equipment may comprise timing means for timing the duration of the said transmitted signals and for indicating to a terminal from which a signal has been transmitted when the duration of that signal has reached a predetermined value. The indication may be provided by, for example, sending to the subscriber signals indicating selected time intervals.

Actuation of a particular signal control member for a first time interval has a first significance, for example a particular digit value, whilst actuation of the same member for a second, different time interval has a second different significance.

The signals sent on actuation of a con-

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trol member may be one or more tones or they may be a direct current or voltage.

By way of example only, an embodiment of the invention will now be described in greater detail with reference to the accompanying drawing which shows the embodiment partly in perspective and partly in block schematic form.

The embodiment is an automatic telephone exchange system integrated with a data storage system incorporating a computer for processing information supplied to the data storage system and for control purposes.

There is shown a push-button telephone set 1 having ten push-buttons, each representing one of the digits 0, 1, 2, 3 . . . 9 which are used by a subscriber to obtain access to another subscriber via a telephone exchange switching network indicated by block 2. It will be assumed to be of the type in which actuation of a push-button causes a tone or tones to be transmitted, which tone or tones defines the particular button.

By operating sequentially a particular combination of push-buttons, a subscriber can also obtain access, via network 2, to a data storage system. The data storage system comprises automatic answering equipment represented by block 3 and connected to the switching network 2 by a communication path 4 having a plurality of communication channels (not shown). The data storage system also includes a response signal control 5, a response signal transmitter 6, a push-button signal detector 7, a signal duration timer 8, a memory block 9 and a computer 10. The construction of the components just mentioned does not form part of the present invention and they are, therefore, shown in block form only. The components are interconnected as indicated by lines 11 . . . 21.

When a subscriber wishes to obtain access to the data storage system, he first actuates sequentially the particular combination of push-buttons and this sets up a connection through the telephone switching network 2 and places the subscriber in communication with the automatic answering equipment 3 via one of the channels of path 4.

The arrival of the call is detected by the automatic answering equipment 3, which provides such answering conditions to the telephone switching network 2 as may be required. For example, equipment 3 would normally be required to trip the received ringing signal. The automatic answering equipment 3 also indicates to the response signal control 5, via line 12, that a call has arrived. The response signal control 5 then causes, via lead 21, the response signal transmitter 6 to transmit a 'ready to set-up' signal to the subscriber via the automatic answer-

ing equipment 3, and the telephone switching network 2. This signal indicates to the subscriber that the computer is ready to receive. The signal which may be applied continuously or for a limited period may take one of several forms e.g. a tone or tones, continuous or interrupted in a predetermined manner, or a verbal announcement, recorded or automatically generated.

The subscriber may now send data to the computer using the push-buttons of his telephone set 1.

When the subscriber actuates a push-button the tone or tones are sent via the telephone switching network 2 and answering equipment 3 to the push-button signal detector 7 which detects the tone or tones received and therefore identifies the push-button which has been actuated by the subscriber.

The push-button signal detector 7 also indicates, over lead 13, to the response signal control 5 that data is being received so that the signal indicating to the subscriber that the call has been received may be terminated in the case when the signal is being continuously applied. The push-button detector 7 also indicates, over lead 15, to the duration timer 8 the receipt of push-button tones and the duration timer 8 measures the period for which the tones persist and hence the period for which the push-button is actuated by the subscriber.

If the duration of button actuation is less than a first predetermined period, typically half a second, the significance of the subscriber's action is deemed to be the first significance of several significances. Normally this first significance would correspond to the normal use of the push-buttons to indicate numerical information. It would indicate the digital value engraved upon or associated with, the individual button. Thus when the duration timer 8 determines a push-button actuation of the aforesaid first significance it indicates this fact over lead 17 to the memory block 9 which accepts the button identity from the push-button signal detector 7 and records it as a first significance signal, typically the digital value as described.

If the duration of button actuation exceeds the first predetermined period but does not exceed a second predetermined period, typically one and half seconds, the significance of the subscriber's action is deemed to be the second significance of several significances. This second significance would be related to the needs of the data being sent. For example, if the requirement includes the sending of alpha characters, the second significance would be the first of say one, two or three letters engraved on, or associated with, the individual buttons.

Another example is that if the needs of the

data being sent require the use of mathematical symbols such as +, -, ÷, ×, etc., the second significance could be these symbols, the association between individual buttons and particular symbols being indicated by a template temporarily placed over the buttons by the subscriber, or by other suitable means; alternatively, the subscriber may memorise the relationship between the second significance and the normal marking of the buttons. When the duration timer 8 determines a button actuation of the second significance it indicates this fact to the memory block 9 which accepts the button identity from the push-button signal detector 7 and records it as a second significance signal.

In like manner, if the duration of the button actuation exceeds the second but not a third predetermined period, typically two and half seconds, the significance of the subscriber's action is deemed to be the third significance of the several significances and be recorded as such in the memory block 9. Likewise if the duration exceeds the third predetermined period the significance of the subscriber's action is deemed to be the fourth significance of the several significances and be recorded as such in the memory block 9.

The third and fourth significances could be used, for example to indicate the second and third letters engraved on, or associated with the individual buttons, or of course any other symbols.

Additional significances may be employed by the use of other longer predetermined timing periods.

In the foregoing description, the subscriber is required to judge the period for which a button is actuated in order to achieve the required significance. This presents little difficulty for a subscriber when two significances only are involved, e.g. one less than half a second and the other greater than half a second. However, when three or more significances are involved some assistance is highly desirable to guide the subscriber, and this is provided in a manner now to be described. The technique, although not essential when only two significances are involved, may be used in this situation in order to enhance co-operation between the subscriber and the data storage system.

The duration timer 8, when it determines that a button has been actuated for the first predetermined period, indicates to the response signal control 5 that the first predetermined period has elapsed. The response signal control 5 thereupon causes a response signal to be sent to the subscriber by the response signal transmitter 6, and the subscriber, upon hearing this signal, knows that the button must be released if it is de-

sired to send a signal with the second significance. However, if the button continues to be actuated the duration timer 8 will in due course determine that the second predetermined period has elapsed. This will be indicated to the response signal control 5, which in turn will cause a different response signal to be transmitted to the subscriber. The subscriber upon hearing this second response signal knows that the button must now be released if it is desired to transmit a signal with the third significance.

In like manner response signals indicate to the subscriber when to release the button to transmit signals with fourth or greater significances.

The response signals may be of several forms, e.g. a tone or combination of tones, continuous or interrupted, or a verbal announcement, recorded or automatically generated. The response signals may be preselected with the same choice of signals used for every connection. Alternatively, the signals used may be varied to suit the particular connection being handled. Information received from the subscriber and stored in the memory block 9 may be processed by the computer 10. The computer 10, by analysing the information received, may determine the nature of the particular connection and the response signals appropriate to it. The decision reached by the computer is conveyed to the response signal control 5 either directly via lead 20 or if appropriate via leads 19 and 18 and the memory block 9.

The use of variable response signals is particularly appropriate when response signals take the form of verbal announcements. For example, when the data being sent by the subscriber is intended to be alpha characters the response signals may be a verbal announcement of the particular letters being sent. In this example, the computer 10 would indicate to the response signal control 5 when the receipt of alphabetical information is expected. If the subscriber now actuates a button which, by way of explanation will be assumed to be marked 2 ABC, this action will be detected by the push-button signal detector 7 as previously described. The identity of the button actuated will be passed to the response signal control 5 and when the duration timer 8 indicates that the first predetermined period has elapsed, the response signal control 5 will cause a verbal announcement 'A' to be transmitted to the subscriber as the response signal referred to earlier.

If the subscriber wishes to send the letter A, the button is released at this time. Likewise, when the second predetermined period has elapsed a verbal response signal 'B' will be transmitted and when the third predetermined period has elapsed a verbal response

signal 'C' will be transmitted, the subscriber thereby receiving clear indication when to release the button and at the same time being reassured that the letter has been correctly identified by the receiving equipment.

When using verbal response signals it may be advantageous to extend the duration of the aforesaid predetermined periods to match the duration of the verbal announcement, i.e. the predetermined period would be measured from the conclusion of the announcement regardless of the duration of the announcement. This would enable the subscriber to hear the announcement in full and then have adequate time to release the button before the predetermined period expires.

It should be understood that no restriction is placed on the location of the computer or data receiving arrangement.

The computer or data receiving arrangement could be in one location remote from the control equipment which in turn is remote from the telephone switching network, or the control equipment could form an integral part of the telephone exchange system, or again both the computer or data receiving arrangement and the control equipment could both form part of the telephone exchange system.

The data storage system may be a relatively simple storage system associated with the computer to enable the latter to perform computation as required by a subscriber on the receipt of the appropriate information and command signals. Alternatively, the storage system might contain information to which the subscriber requires access from time to time either for the purpose of updating the information or for record or other purposes.

WHAT WE CLAIM IS:—

1. The combination, with an automatic telephone exchange system, of a data storage system including data receiving equipment and a plurality of data transmitting terminals each of which is connected to the switching network of the exchange system and includes a subscriber's telephone instrument having a plurality of signal control members actuatable to control the switching network either to obtain access to another subscriber's telephone instrument or to obtain access to the data receiving equipment and then to transmit to the data receiving equipment further signals whose significance depends upon the time interval for which the control member is actuated, the data receiving equipment comprising means responsive to the transmitted signals and to the duration thereof.

2. The combination as claimed in claim 1, in which the data receiving equipment comprises timing means for timing the duration of the said transmitted signals and for indicating to a terminal from which a signal has been transmitted when the duration of that signal has reached a predetermined value.

3. The combination, with an automatic telephone exchange system, of a data storage system, the combination being substantially as described herein with reference to, and as illustrated by, the accompanying drawings.

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